Feasibility of Copper Fertilization for Optimum Crop Yield in the Canadian Prairies

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What is Copper?

- Copper (Cu) is an essential soil nutrient required for plant growth.
- It is important for many biochemical processes such as:
    - Seed/grain production and formation.
    - Chlorophyll formation which directly affects photosynthesis.
    - Enzyme activity Copper is required in relatively small amounts.
- Therefore considered a micronutrient.
- If over-applied or applied close to the seed, Cu can be toxic.
- Toxic effects of over-applied Cu can last several years in the field.

Copper Deficiency Characteristics and Symptoms

- Copper (Cu) deficiencies are not widespread in Saskatchewan, but can drastically reduce yield where they occur.
- Deficiencies are most common on organic (peat) soils and coarse textured (sandy) soils.
- High levels of other nutrients like phosphorus, nitrogen or zinc in soil or fertilizer can aggravate Cu deficiencies.
- Copper deficiencies can increase the incidence or severity of some diseases. (i.e., stem melanosis, take-all, powdery mildew, and ergot on wheat; wilting of alfalfa leaves).

Deficiency symptoms include:

- Yellowing and curling of young leaves.
- Pig-tailing (curling) of leaf tips.
- Delayed heading.
- Aborted heads or spikelets.
- Stem and head bending.
- Brown discoloration on stems (i.e., stem melanosis).

Crop Sensitivity to Copper Deficiency

Crop sensitivity to Cu deficiency is typically in the following order:
(Ranked: 1 (Most sensitive) to 5 (Least sensitive))

1. Wheat, Flax, Canaryseed
2. Barley, Alfalfa
3. Timothy Seed, Oat, Corn
4. Pea, Clover
5. Canola, Rye, Forage grasses

Correcting Copper Deficiency

- Broadcast and incorporation of granular Cu fertilizer at 2.7 to 5.06 lbs Cu/acre before seeding is an effective method to correct Cu deficiency.
- Spray and incorporation of liquid Cu fertilizer at 0.9 to 1.8 lbs Cu/acre formulations is also effective.
- Low-rate liquid (0.18 to 0.25 lbs Cu/acre) foliar application between tillering and the flag leaf stage can correct Cu deficiencies in-season.
- Surface broadcast or seed-row applied granular Cu fertilizer is not highly effective.
- High Cu fertilizer rates can have residual benefits in subsequent years.
- Broadcast and incorporation of granular Cu fertilizer at 1.8 lbs Cu/acre is not generally effective to correct Cu deficiency in the year of application.
- If applying rates of granular Cu fertilizer are less than 2.7 lbs Cu/acre, repeat applications over several years may be required to correct Cu deficiencies.
- Not all forms of Cu fertilizers are equally effective.
- The effectiveness of a Cu source depends on its solubility in water which in turn affects the amount of available Cu for plant uptake and yield.
- Cu fertilizers containing oxides are of relatively low solubility.

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